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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No. : 10/707,465 Confirmation No. **1464**
Applicant : Mark A. Rosenzweig et al.
Filed: : December 16, 2003
TC/Art Unit: : 1763
Examiner : Roberts P. Culbert

Docket No. : 13DV-13863
Customer No. : 30952

Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

DECLARATION UNDER 37 CFR §1.132

We, Mark A. Rosenzweig and Jeffrey A. Pfaendtner, depose and say that:

(1) We are joint inventors of the subject matter covered by the claims pending in the above-identified patent application ("Application").

(2) Mr. Rosenzweig was granted a Bachelor of Science degree in Metallurgical Engineering from the University of Pittsburgh, and has been employed as an engineer with General Electric Company, GE Aircraft Engines, from 1990 to 1995 and from 1997 to the present. During the course of his employment, he has been engaged in the research and development of oxidation and corrosion resistant coatings and thermal barrier coating systems for components of gas turbine engines, including the development of materials and deposition processes for such coating systems. Additionally, he has over

Application No. 10/707,465
Technology Center 1763
Amendment dated September 27, 2006
Reply to Office Action of April 18, 2006

seven years experience in development and application of chemical processes for turbine engine components, which includes cleaning, etching, coating removal, electroplating, anodizing, and painting.

(3) Mr. Pfaendtner was granted a B.S.E and Ph.D. from the University of Pennsylvania in Materials Science and Engineering, and has been employed as an engineer with General Electric Company, GE Aircraft Engines, from 1998 to the present. During the eight years of his employment, he has been engaged in the development of next-generation materials and processes for high-temperature protective coatings for use in the hot sections of jet engines (e.g., combustor, turbine, augmentor). These materials include metallic bond coat and environmental coatings, as well as ceramic thermal barrier coatings. Additionally, he has been active in the development of physical vapor and chemical vapor coating processes (PVD and CVD), as well as other chemical processes for the deposition of metallic and oxide coatings.

(4) The invention covered by the claims of the Application is a process for removing oxide particles that adhere to surfaces of internal cavities as a result of oxidation and sintering of coating particles to these surfaces during an aluminizing process in which the coating particles are the source of aluminum for aluminizing the surfaces. The invention uses an aqueous caustic hydroxide solution to remove the oxide particles from the aluminized surfaces.

(5) We understand that the claims of the Application are rejected as being obvious over the "Background of the Invention" in the Application in view

Application No. 10/707,465
Technology Center 1763
Amendment dated September 27, 2006
Reply to Office Action of April 18, 2006

of processes described in one or more of the following: U.S. Patent No. 6,475,289 to Schilbe et al. (Schilbe); U.S. Patent No. 6,265,022 to Fernihough et al. (Fernihough); U.S. Patent No. 5,707,453 to Shurman et al. (Shurman); and U.S. Patent Application Publication No. 2005/0035086 to Chen et al. (Chen).

(6) This Declaration is being submitted in a first response after a final rejection to address statements made by the Examiner in the final rejection that we had previously "provided only unsupported argument that the sintered oxides after formation are somehow different or are bonded in a different manner" than particles removed by Schilbe, Fernihough, Shurman, and Chen.

(7) We and our co-inventors conceived the claimed process after encountering difficulties with removing oxidized coating particles that had sintered to internal wall surfaces following aluminization of the walls. Because the particles form and adhere in-situ through a combined process of oxidation of the particles, sintering of the particles, and aluminization of the walls, the particles are firmly attached to the aluminized walls through a combination of fusion with the wall surfaces as a result of the oxidation and sintering processes and bonding with aluminum from the aluminizing process.

(8) While the use of KOH and other aqueous caustic hydroxide solutions to remove engine-deposited dirt (such as Schilbe and Shurman), hot corrosion products (such as Chen), and ceramic plugs (such as Fernihough) may have been known, the contaminants removed by Schilbe, Shurman,

Application No. 10/707,465
Technology Center 1763
Amendment dated September 27, 2006
Reply to Office Action of April 18, 2006

Chen, and Fernihough are so different from the oxidized, sintered, and aluminized particles we were trying to remove that it was not obvious to us or our co-inventors that a caustic solution such as KOH would work.

(a) The nature of dirt deposits (such as Schilbe and Shurman) is significantly different from aluminum oxide formed in-situ during aluminizing. Internal confidential GE reports documenting the nature of dirt deposits include GE Aircraft Engines Technical Memorandum 2000-117 and GE Research and Development Center Technical Information Series 99CRD167. Though these reports must be kept confidential, the following facts from these reports can be reported as follows. Oxide particles from engine dirt and debris typically comprise components based upon aluminosilicates modified with iron, magnesium, calcium, potassium, and other potential impurities. While pure alumina may be present in the dirt deposits, many other chemicals are also present. The microstructure of these dirt deposits may range from polycrystalline to amorphous or even glassy. The interface with the base metal is typically well defined with only limited interaction with the deposit, since the operating environment on the internal cavities is less than about 1600°F.

(b) The nature of hot corrosion deposits (such as Chen) is also significantly different from aluminum oxide formed in-situ during aluminizing. Internal confidential GE reports documenting the nature of hot corrosion products include GE Aircraft Engines Technical Memorandums 92-443 and 93-236. Though these reports must also

Application No. 10/707,465
Technology Center 1763
Amendment dated September 27, 2006
Reply to Office Action of April 18, 2006

remain confidential, the following facts from these reports can be reported as follows. Hot corrosion products are formed by definition in the presence of corrodants, typically a sodium and sulfur containing compound. The nature of hot corrosion is to break down and flux the protective alumina scale that forms on bare or coated nickel-based superalloys. The scale formed typically is mixture of alumina plus nickel and chromium oxides. The scale may contain impurities contributed by the corrodant, (primarily Na and S), from the base metal (Ti, Ta, W, Mo, etc.), and from the ever-present engine dirt (Ca, Fe, Mg, K, etc.). The microstructure of hot corrosion products is typically voluminous, layered, porous, and non-adherent, which contribute to the rapid degradation from hot corrosion. While the corrosion products are formed by chemical reaction with the base metal or coating, the interface temperatures typically are less than 1700°F at the corrosion front.

(c) The nature of ceramic plugs would also be significantly different from the aluminum oxide formed in-situ during aluminizing. The nature of the ceramic plug materials as described in Fernihough is not entirely clear. Reference is made to oxides of various metals, aluminum oxide being only one. Fernihough seems to emphasize ceramic plugs that contain mixtures of ceramic components and possibly also organic binders. It is important to note that the plug material is a foreign material introduced to the component. It would be expected to have a definite physical and chemical interface between the component base metal and the ceramic plug. Also the

Application No. 10/707,465
Technology Center 1763
Amendment dated September 27, 2006
Reply to Office Action of April 18, 2006

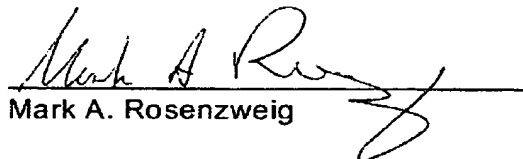
intended temporary nature of the ceramic plug would lead toward the tendency for it to be porous and contain only a green strength and not be fully hard and densified. It is not clear at what temperature that the plug material in Fernihough may be formed. Either the mask or plug material is organic (claim 6), and the mask material and/or plug is subjected to some unidentified temperature which either removes the mask and/or sinters the plug (column 6, lines 9-13). The temperature cannot be extremely high, perhaps less than 1000°F, given that one of the components is organic. Indeed, the plug material can be at least partially removed by subjecting it to 600°C for two hours (column 6, line 28). So in summary, the plug material of Fernihough can be inferred to be porous, not well bonded to the substrate, formed at low temperatures, and possibly containing many constituents other than pure alumina.

(d) By contrast, the material removed from the internal cavities of turbine components according to the Application can be characterized as pure alumina, either from the aluminum oxide powder (one of the components of the aluminizing mixture), or from aluminum oxide that only can form within the inert gas or partially reducing atmosphere of the aluminizing process. This pure alumina is well bonded to the surface by nature of the high temperature of formation (1700°F and greater) and by the nature of the growth by atomic diffusion. While caustic solutions have been known to clean and remove oxides from turbine components, it was not obvious that caustic solutions would successfully remove the distinctly different,

Application No. 10/707,465
Technology Center 1763
Amendment dated September 27, 2006
Reply to Office Action of April 18, 2006

well-bonded, and chemically pure, aluminum oxides formed in-situ by an aluminizing process.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.


Mark A. Rosenzweig

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

 9-25-06
Jeffrey A. Pfaendtner